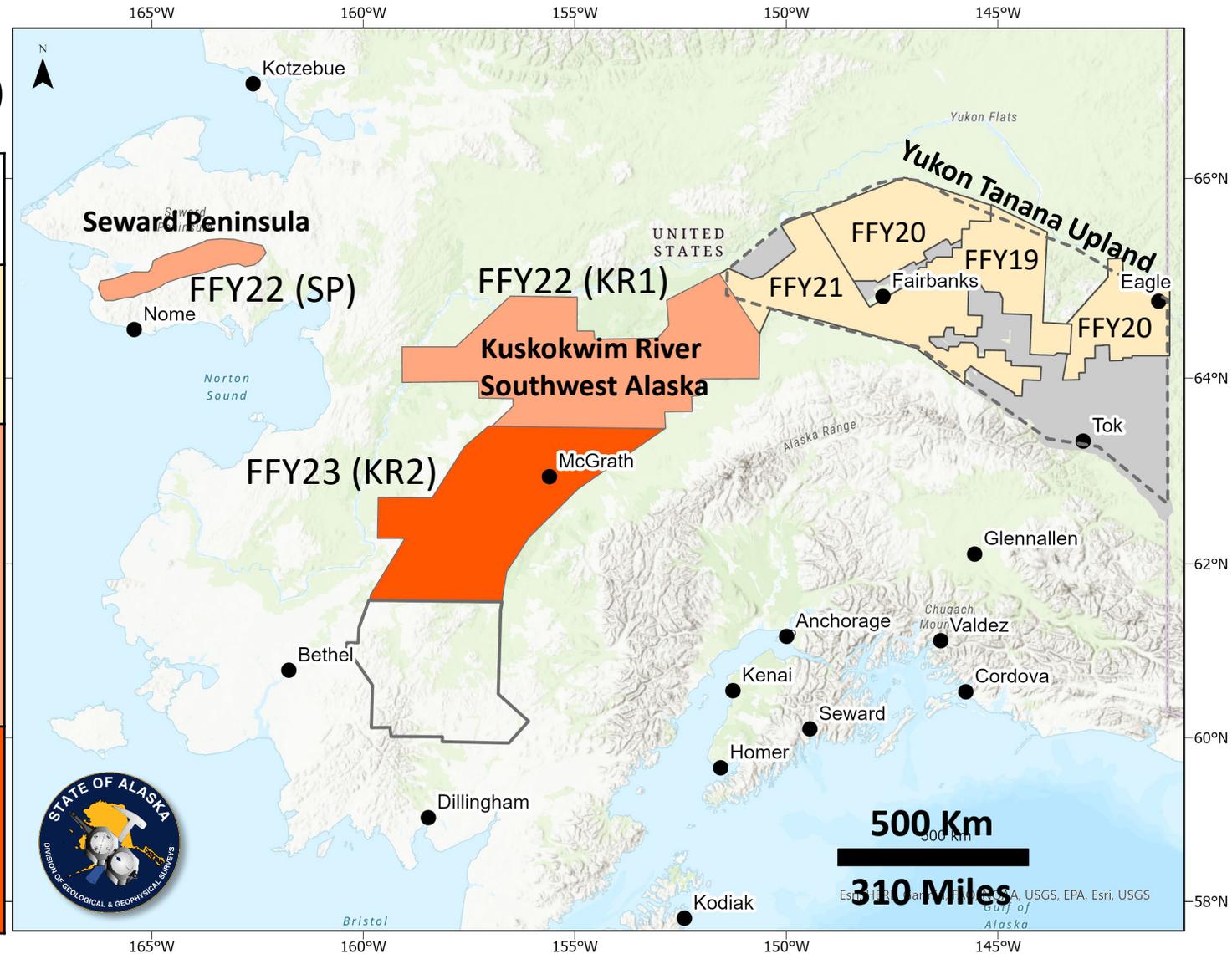


Alaska's Earth MRI Geophysics Program

- Modern, Tier II magnetic + radiometric surveys
- Yukon Tanana Upland completed magnetics
- SW Alaska (in progress); Seward Peninsula (Aug. 1)

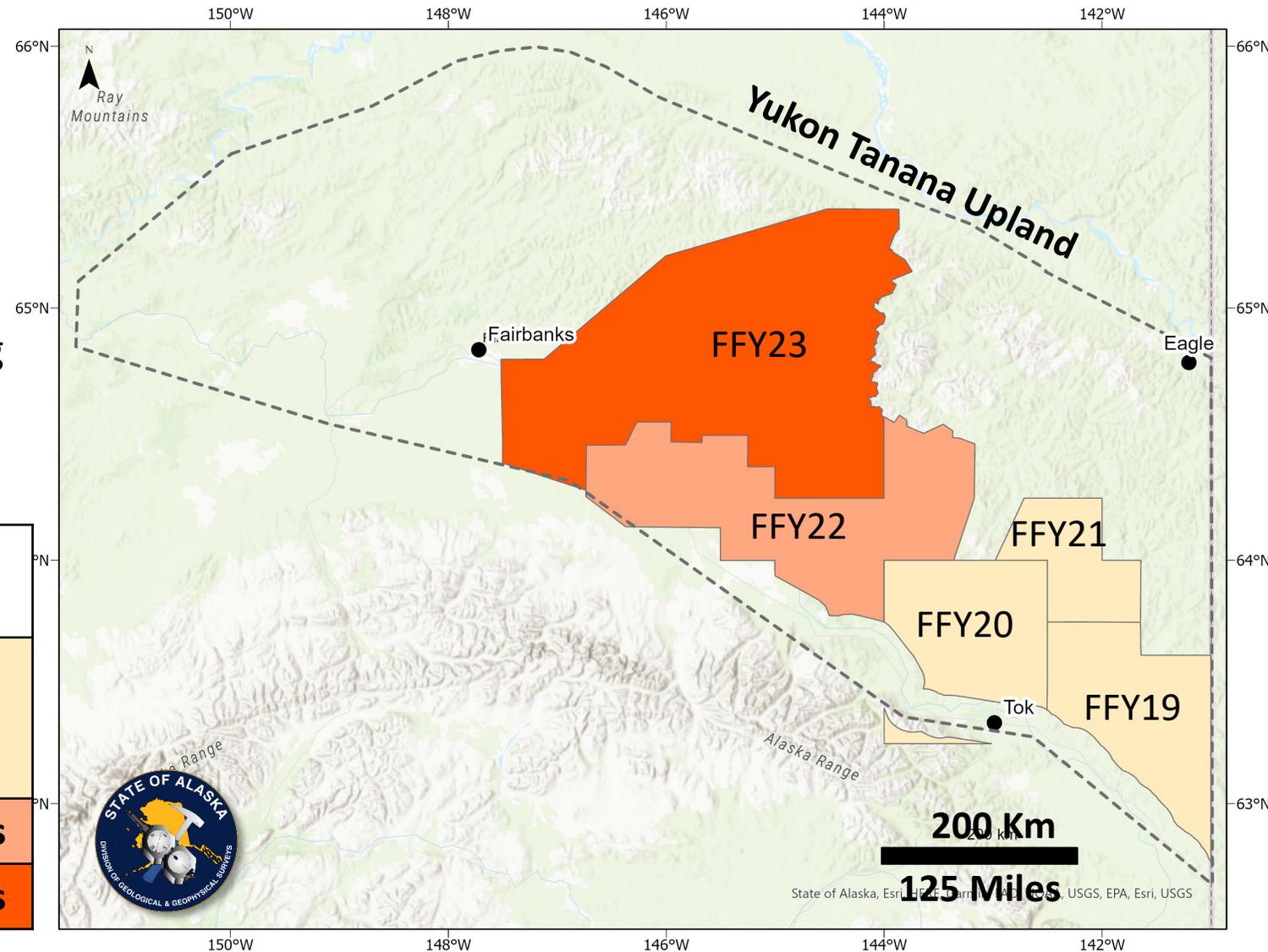
Federal FY	Square Km	Type(s)	Status
2019 2020 2021	56,000 total	Fixed-wing magnetics, radiometrics	Complete Complete Complete
2022	45,000	Fixed-wing & helicopter magnetics, radiometrics (KR1); Helicopter time- domain EM (SP)	KR1 started May 14; SP starts August 1
2023	40,000	Fixed-wing & helicopter magnetics, radiometrics (KR2)	KR2 data collection summer 2024



Alaska's Earth MRI Geologic Mapping Program

YUKON-TANANA UPLAND

- Existing mapping primarily 250,000 scale
- New EMRI 100,000-scale geologic mapping (19,500 square km to date)
- Summer 2023 EMRI project (June 5-August 13; additional 14,500 square km)
- Significantly changing geologic understanding of YTU and its mineral-resource potential



Federal FY	Square Km	Map Name	Status
2019	11,500	E. Tanacross	Complete
2020	total	W. Tanacross	Complete
2021		Taylor Mountain	Complete
2022	8,000	Mt. Harper	In progress
2023	14,500	Chena	In progress



Planned Geochemical Re-Analyses - FFY2023-26



New geochemical anomalies can be found by re-analyzing historical stream-sediment samples with modern analytical methods

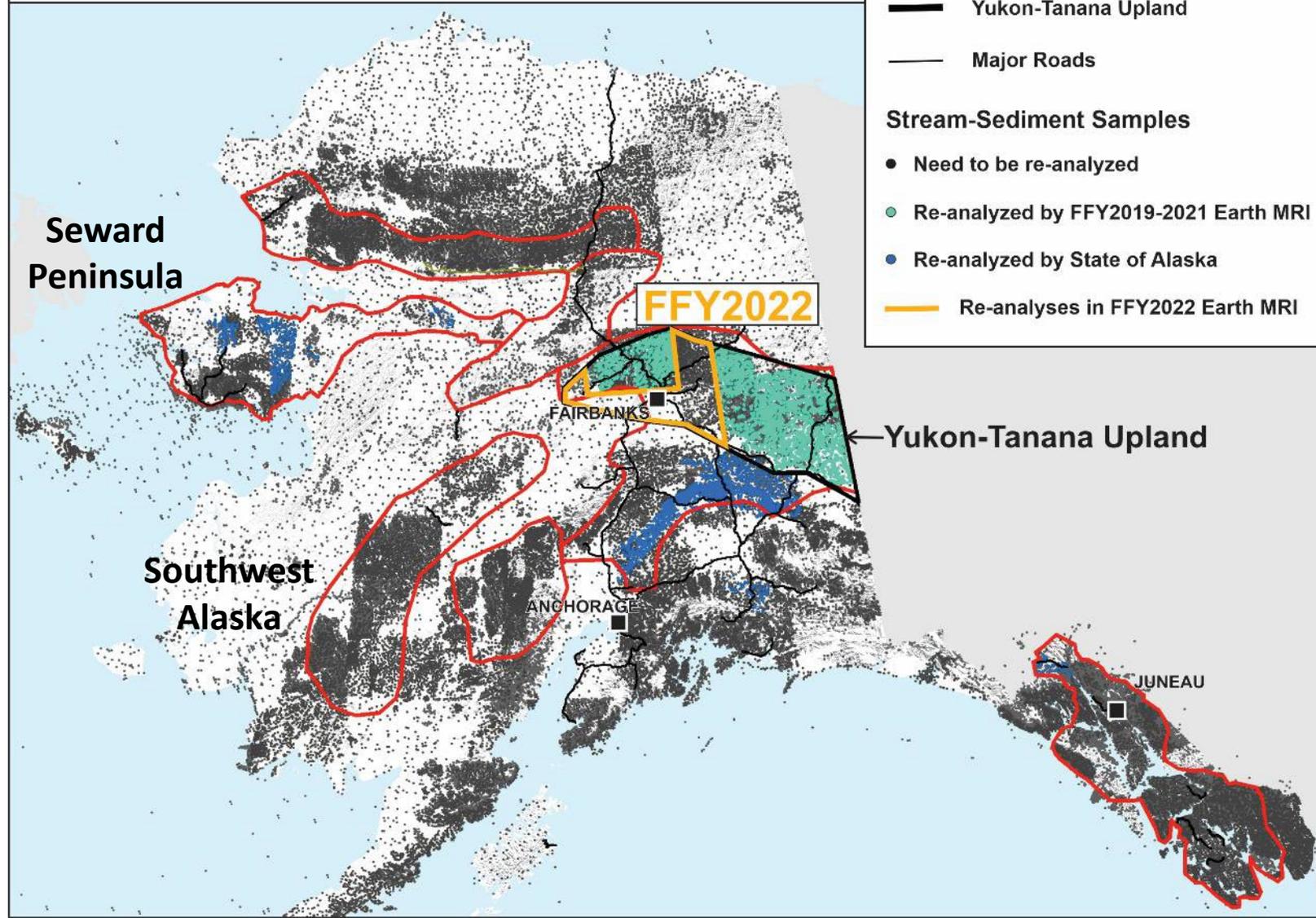
Older data is missing elements of interest, has poor detection limits, or used non-quantitative methods

FFY2022 – Re-analyze 2,500 additional stream-sediment samples in Yukon-Tanana Upland

FFY2023-2026 – Re-analyze samples in Southwest Alaska and Seward Peninsula

Goal is to complete geochemical re-analyses of all stream-sediment samples within Alaska's Critical Mineral Belts (red outlines) – 10 years

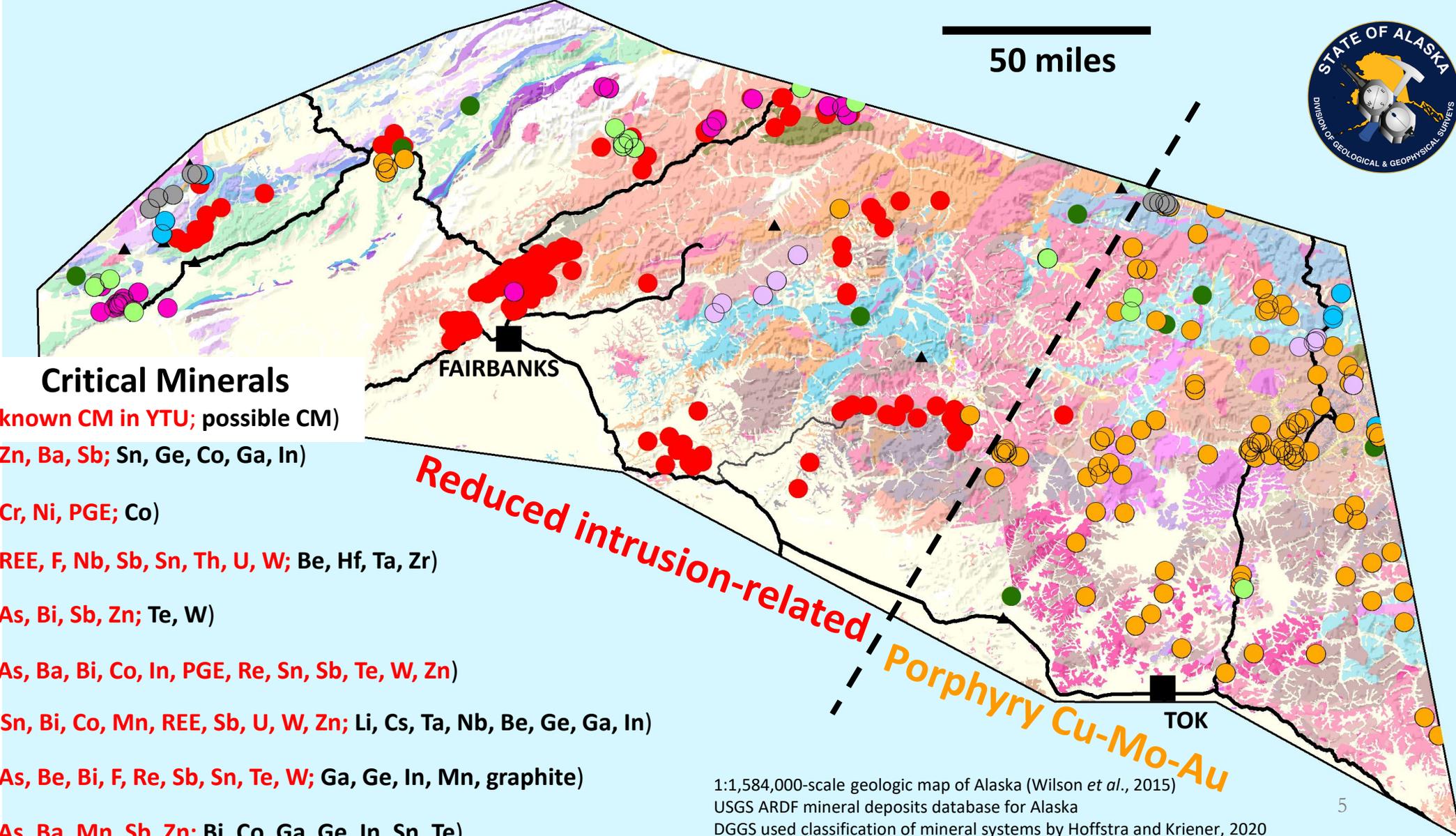
Geochemical Re-analyses



Yukon-Tanana Upland - Critical-Minerals in Lode Deposits



50 miles



Known Mineral Occurrences

Color Coded By Mineral System

- ▲ Unknown mineral system (**known CM in YTU; possible CM**)
- Basin brine path (**Zn, Ba, Sb; Sn, Ge, Co, Ga, In**)
- Mafic magmatic (**Cr, Ni, PGE; Co**)
- Magmatic REE (**REE, F, Nb, Sb, Sn, Th, U, W; Be, Hf, Ta, Zr**)
- Orogenic (**As, Bi, Sb, Zn; Te, W**)
- Porphyry Cu-Mo-Au (**As, Ba, Bi, Co, In, PGE, Re, Sn, Sb, Te, W, Zn**)
- Porphyry Sn (granite-related) (**Sn, Bi, Co, Mn, REE, Sb, U, W, Zn; Li, Cs, Ta, Nb, Be, Ge, Ga, In**)
- Reduced intrusion-related (**As, Be, Bi, F, Re, Sb, Sn, Te, W; Ga, Ge, In, Mn, graphite**)
- Volcanogenic seafloor (**As, Ba, Mn, Sb, Zn; Bi, Co, Ga, Ge, In, Sn, Te**)

Critical Minerals

1:1,584,000-scale geologic map of Alaska (Wilson et al., 2015)
 USGS ARDF mineral deposits database for Alaska
 DGGS used classification of mineral systems by Hoffstra and Kriener, 2020

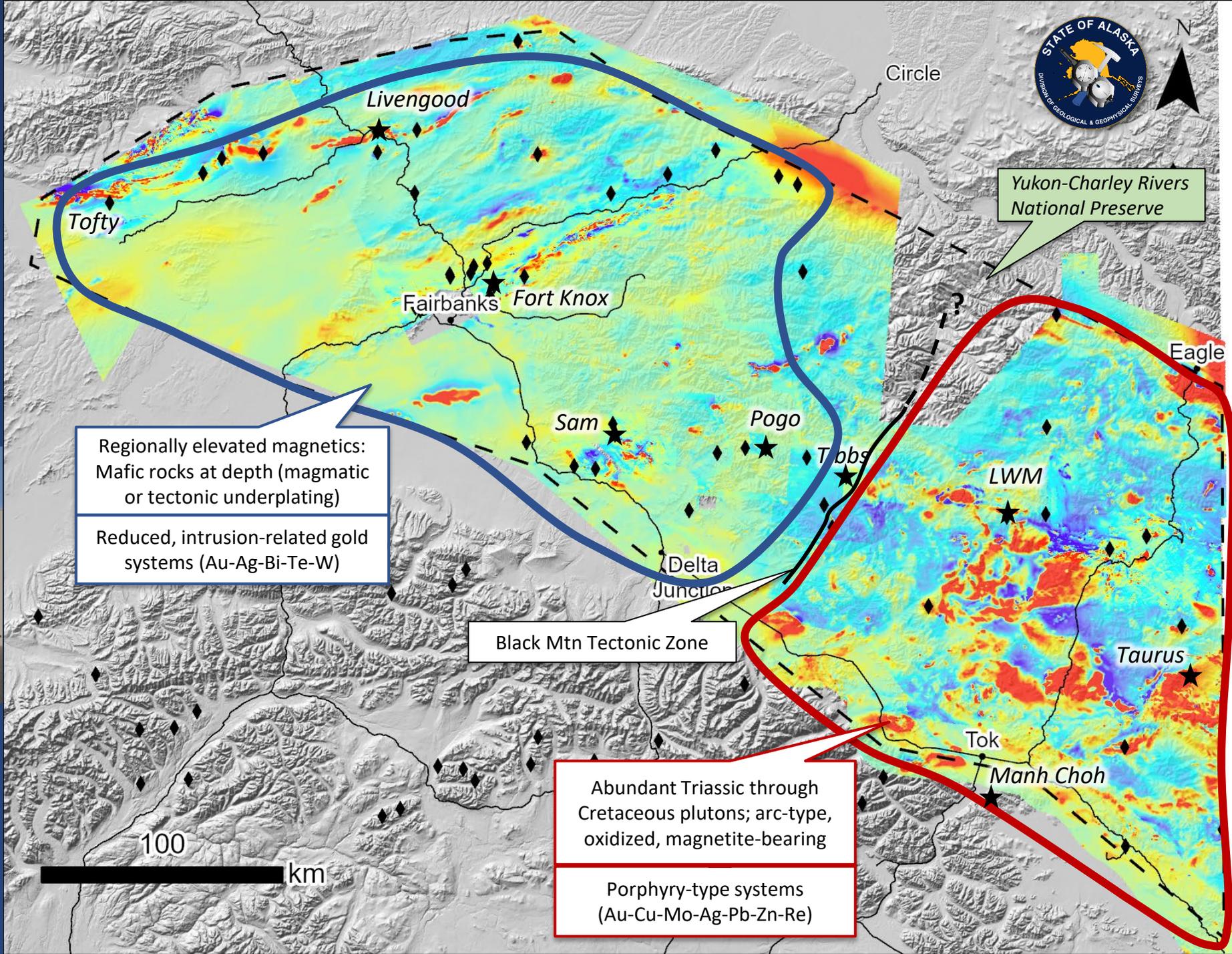
Yukon Tanana Uplands

Magnetics

- Modern dataset completed
- Visually merged
- True merged-data grids are planned



Residual magnetic field

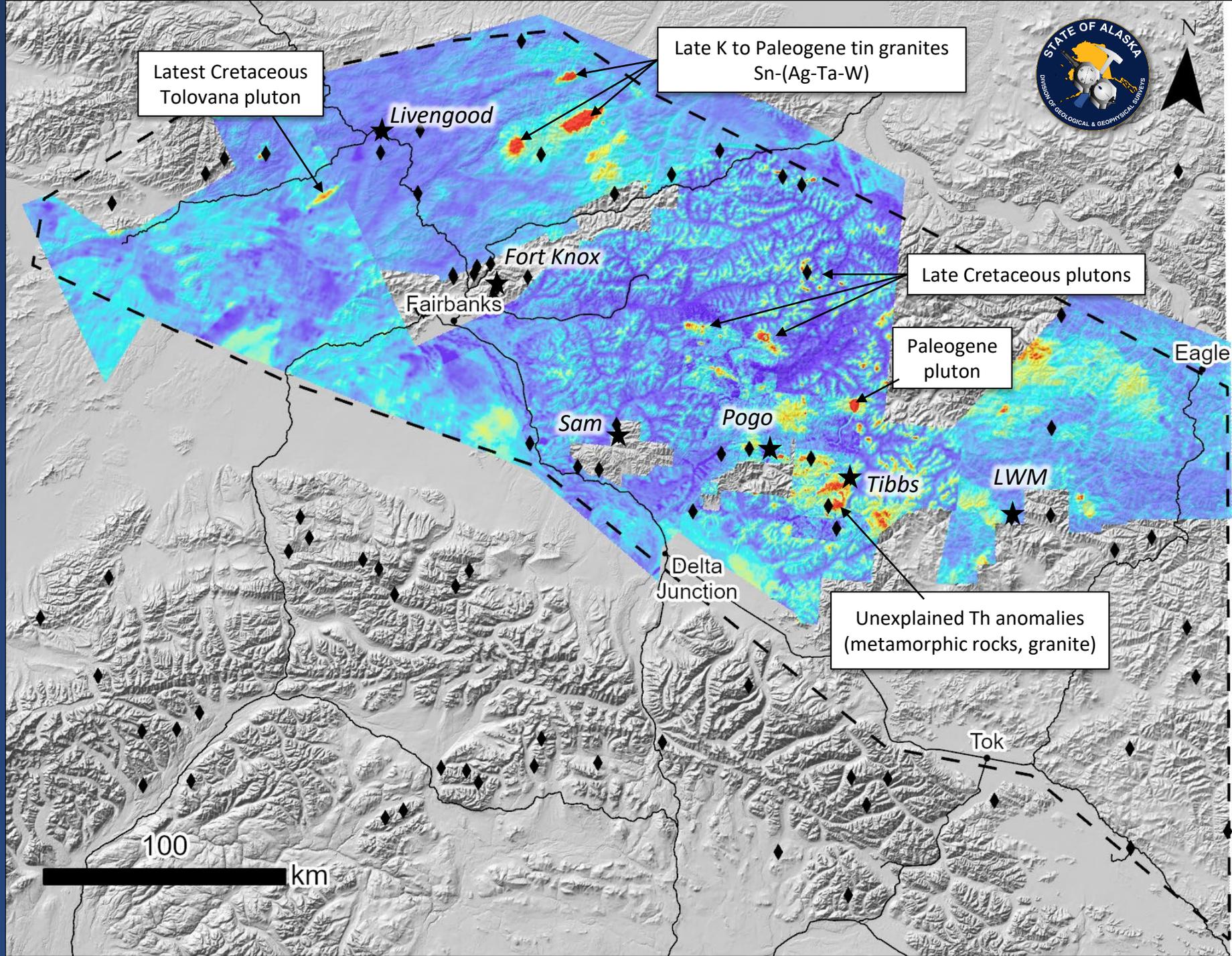


Yukon Tanana Upland Surveys

Radiometrics

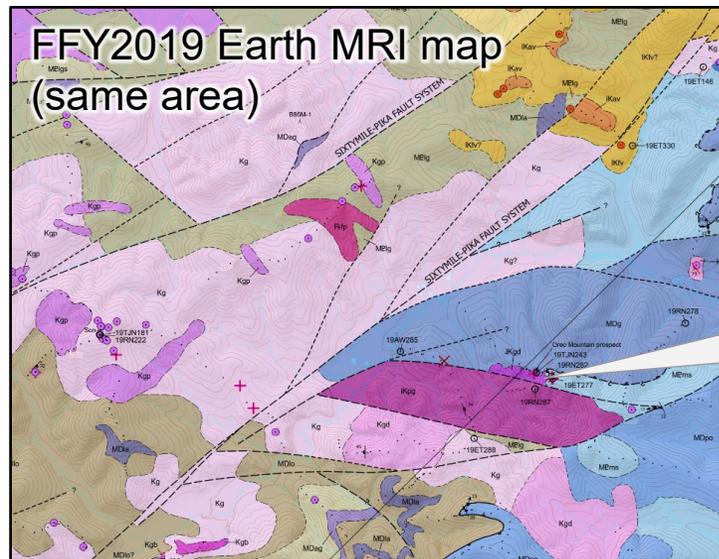
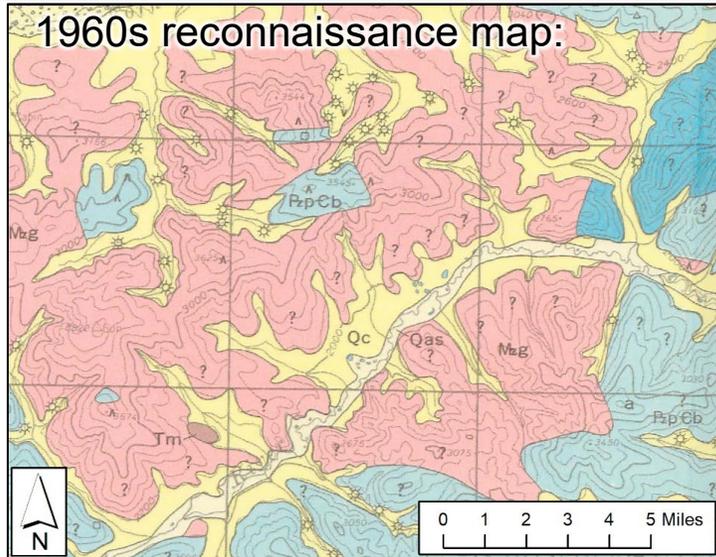
- Obtained “Opportunistic” radiometric data during magnetic surveying (not optimized for radiometric data collection)
- Area is partially covered/vegetated, resulting in some noise, topo signal
- Late Cretaceous-Paleogene plutonic suites are clearly mapped, especially by Thorium

Th equivalent

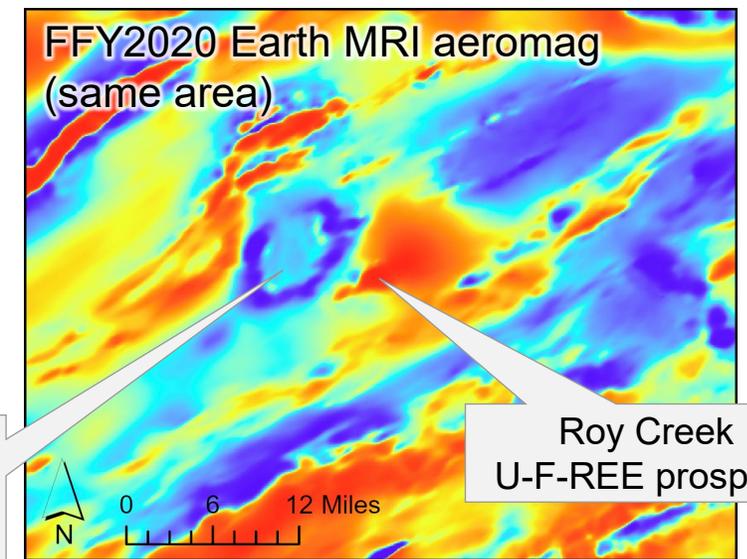
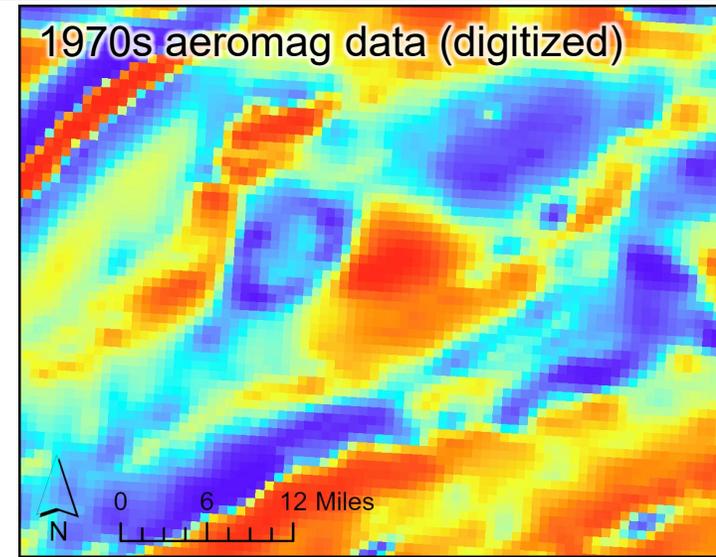


Examples of Improvements from Earth MRI Work

Geologic mapping: Tanacross Quadrangle, eastern Alaska



Geophysical surveys: White Mountains, interior Alaska



Oro Mountain
Cu-Mo±Re
prospect

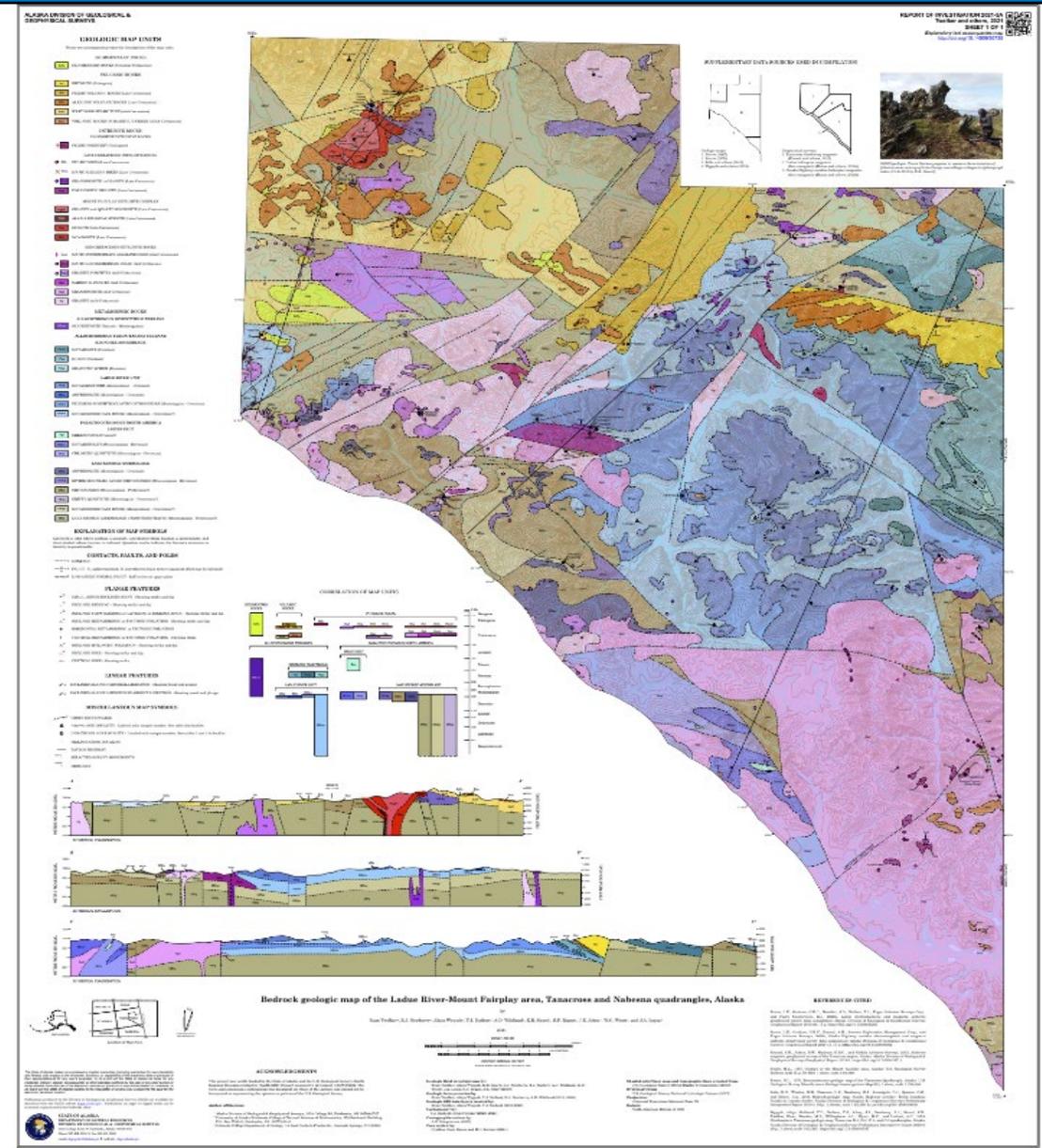
Cache Mtn
Sn-W skarns,
greisen

Roy Creek
U-F-REE prospect



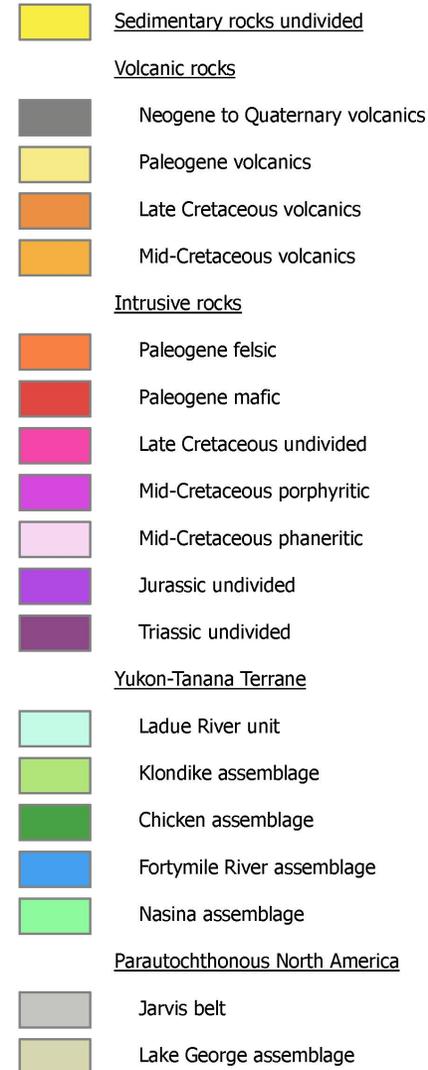
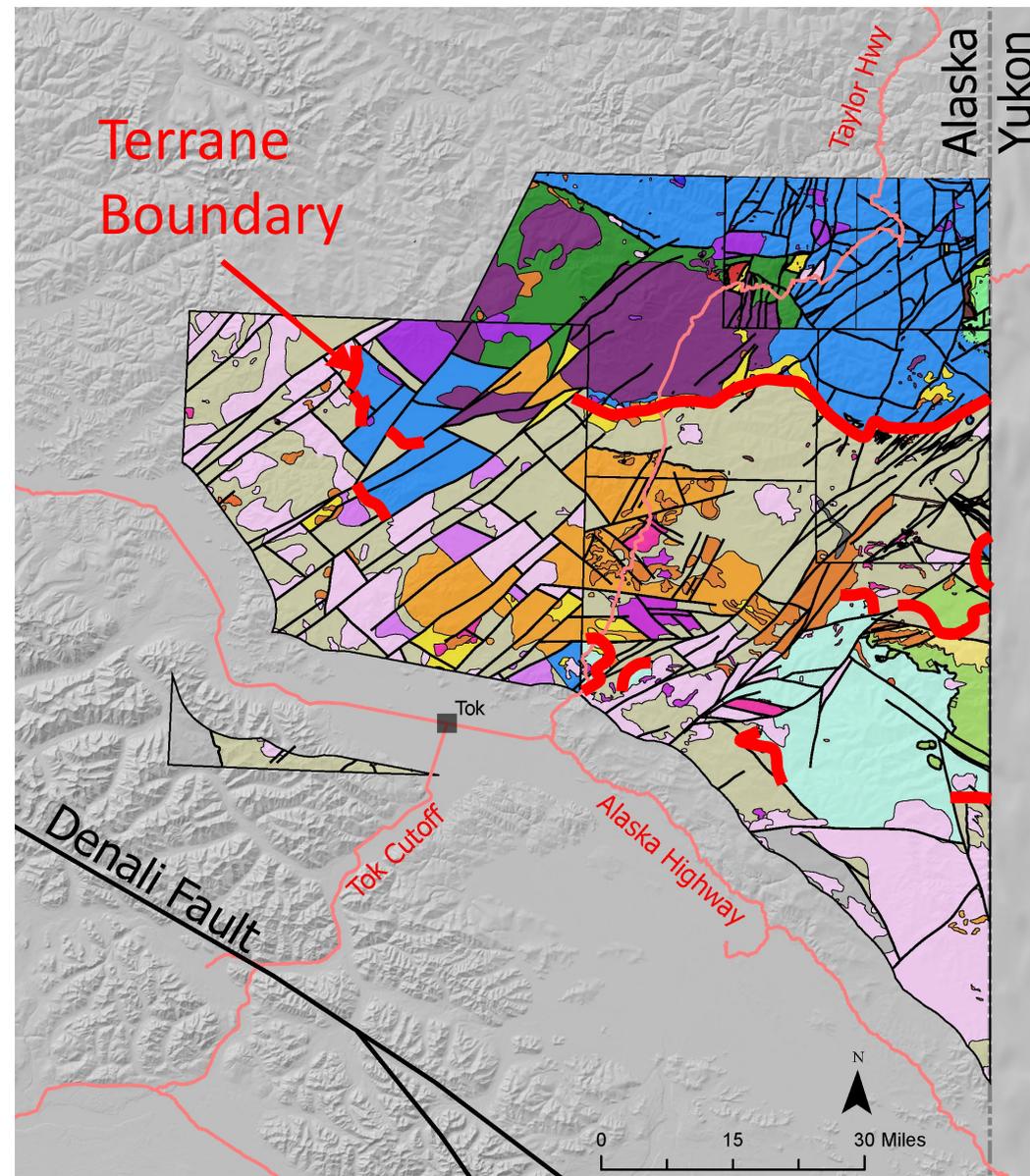
FFY2019 Earth MRI – Eastern Tanacross

- First EMRI project was in the E. Tanacross area of the YTU
- 1,860 mi² (4,800 km²) were mapped at 1:100,000
- Tertiary/Cretaceous magmatism mapped in detail
 - Defined, dated, & characterized new map units
 - Helps understand mineral potential (Cu, Au, Mo, REE)
 - Mt. Fairplay petrology and REE-potential study
- Paleozoic metamorphic terranes significantly re-mapped
 - Resolved Yukon “border fault” & broader scientific Qs:
 - Mesozoic tectonic assembly of Interior Alaska
 - VMS and orogenic-Au metallogeny implications
- Published summer 2021



Terranes, Assemblages, Structures, Magmatism

- Mapping boundary between the overlying allochthonous Yukon-Tanana Terrane & underlying parautochthonous North America (bold red line).
- Defining assemblages within terranes
- Determining metamorphic grade, conditions, & structures
- Locating high-angle faults broadly related to the regional-scale, Denali and Tintina strike-slip fault systems
- Distinguishing Triassic, Jurassic, Cretaceous, and Tertiary magmatic suites
- Evaluating the YTU's mineral-resource potential



Alaska's FFY2019-2022 Earth MRI Publications



Geologic Maps & Reports

FFY2019 Eastern Tanacross

Field stations, magnetic susceptibility data

<https://doi.org/10.14509/30268>

Geochemical data <https://doi.org/10.14509/30267>

U-Pb zircon data <https://doi.org/10.14509/30732>

$^{40}\text{Ar}/^{39}\text{Ar}$ data <https://doi.org/10.14509/30466>

Geologic map <https://doi.org/10.14509/30735>

Professional geologic report <https://doi.org/10.14509/30734>

Regional metamorphic correlations <https://doi.org/10.14509/30737>

Structural geology <https://doi.org/10.14509/30738>

Igneous rocks geochemistry <https://doi.org/10.14509/30739>

Economic geology <https://doi.org/10.14509/30740>

Sedimentary rocks U-Pb DZ <https://doi.org/10.14509/30683>

REE study & geologic report <https://doi.org/10.14509/30736>

Mount Fairplay igneous complex <https://doi.org/10.14509/30463>

Presentation <https://doi.org/10.14509/30429>

Geologic map poster <https://doi.org/10.14509/30414>

FFY2020 Western Tanacross

Field stations, magnetic susceptibility data

<https://doi.org/10.14509/30838>

Geochemical data <https://doi.org/10.14509/30844>

U-Pb zircon report <https://doi.org/10.14509/30732>

FFY2021 Taylor Mountain

Field station locations, magnetic susceptibility data

<https://doi.org/10.14509/30837>

Geochemical data <https://doi.org/10.14509/30843>

U-Pb zircon report <https://doi.org/10.14509/30732>

Presentation <https://doi.org/10.14509/30910>

FFY2022 Mt. Harper

Field stations, magnetic susceptibility data

<https://doi.org/10.14509/30963>

Geochemical Re-analyses

Yukon Tanana Uplands completed (DGGS & USGS publications)

Southwest Alaska (requested)

Airborne Geophysical Surveys

Presentation <https://doi.org/10.14509/30911>

FFY2019 + 2021 Tanana River & Big Delta magnetic + radiometric

survey <https://doi.org/10.14509/30899>

FFY2020 Eagle airborne magnetic and radiometric geophysical

survey <https://doi.org/10.14509/30755>

FFY2022 White Mountains airborne magnetic and radiometric

geophysical survey <https://doi.org/10.14509/30756>

Products & Publications



- All data served out via DGGS website: <https://dggs.alaska.gov/>
- Geophysical surveys (published in variety of industry-standard formats)
- Geochemical reports and databases
- Geochronological reports and databases
- Field-station + magnetic susceptibility databases
- Geologic maps:
 - Bedrock + surficial maps
 - Bedrock-only maps (interpret under cover using geophysics)
 - Associated topical interpretive reports (mineral-resource potential, structural history, metamorphism, igneous suites, geochronology, etc.)

Exploration Geochemistry Web App

Geophysics Web App

Scan to view:

- GIS layer service links
- survey boundaries, survey information, download links from new feature service
- changeable data layers and display filters
- upcoming surveys
- gridded data from new image service

Geologic Map Index Web App

Filter by Text Values

keyword contains

Example: GeMS, Resource Assessment, or Bedrock

title contains

Example: Tanacross

author contains

Example: Gillis

Filter by Date Range

publication date is on or before

today

publication date is on or after

1/1/1961

Filter by Scale Range

map scale is smaller than

map scale is larger than

Example: type 63360 for 1:63,360 maps

Example: type 1,000,000 for 1:1,000,000 maps

Include only DGGS Maps

map index	publication number	title	author	publication date	agency	url	outline
MP 54		Survey of geology, geologic materials, and geologic hazards in proposed access corridors in the Bettles Quadrangle	Reger, R.D., Campbell, B.W., Stevens, D.S.P., and Smith, R.L.	11/30/2003	DGGS	https://dggs.alaska.gov/pubs/id/2968	Map C